



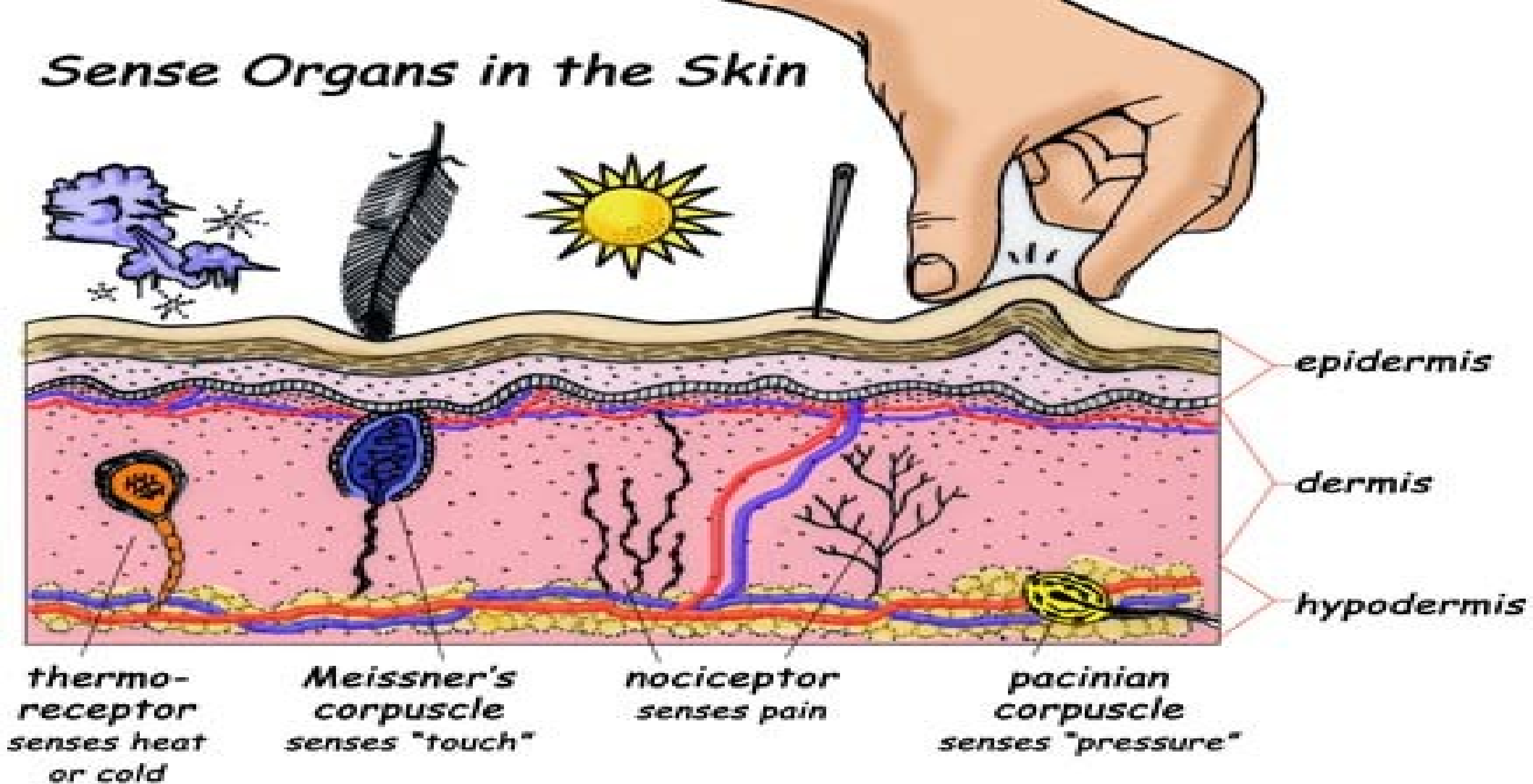
Armed Forces College of Medicine AFCM



Receptors & Synapses

Ass.Prof./ Asmaa Abd Elmonem Abo Zeid

Sense Organs in the Skin



INTENDED LEARNING OBJECTIVES (ILO)



• ***By the end of this lecture you will be able to:***

- 1. Describe the microscopic structure of receptors.**
- 2. Correlate the structure of receptors to their functions.**
- 3. Describe different types of synapses.**



1.Part 1 (5 min) Introduction

2.Part 2 (35 min) Main lecture: Key points:

- Definition and classification of receptors.
- Free nerve endings.
- Peritricheal nerve endings.
- Merckel's disc.
- Pacinian corpuscle.
- Meissner's corpuscle.
- Krause end bulb.
- Ruffini's corpuscle.
- Structure and classification of synapses.

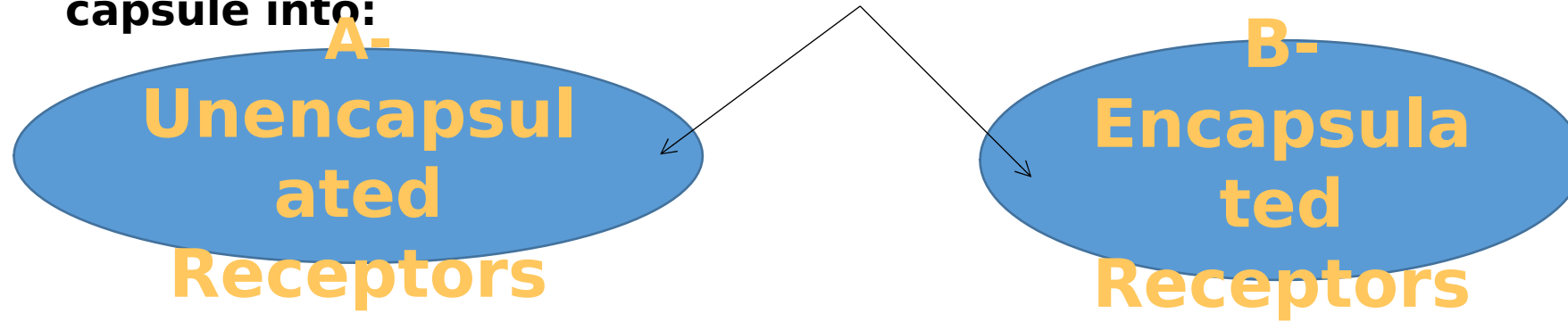
3. Part 3 (5 min) Summary

RECEPTORS



are special structures present at the terminal ends of sensory nerves that receive stimuli and transmit them

- Classified according to presence of capsule into:



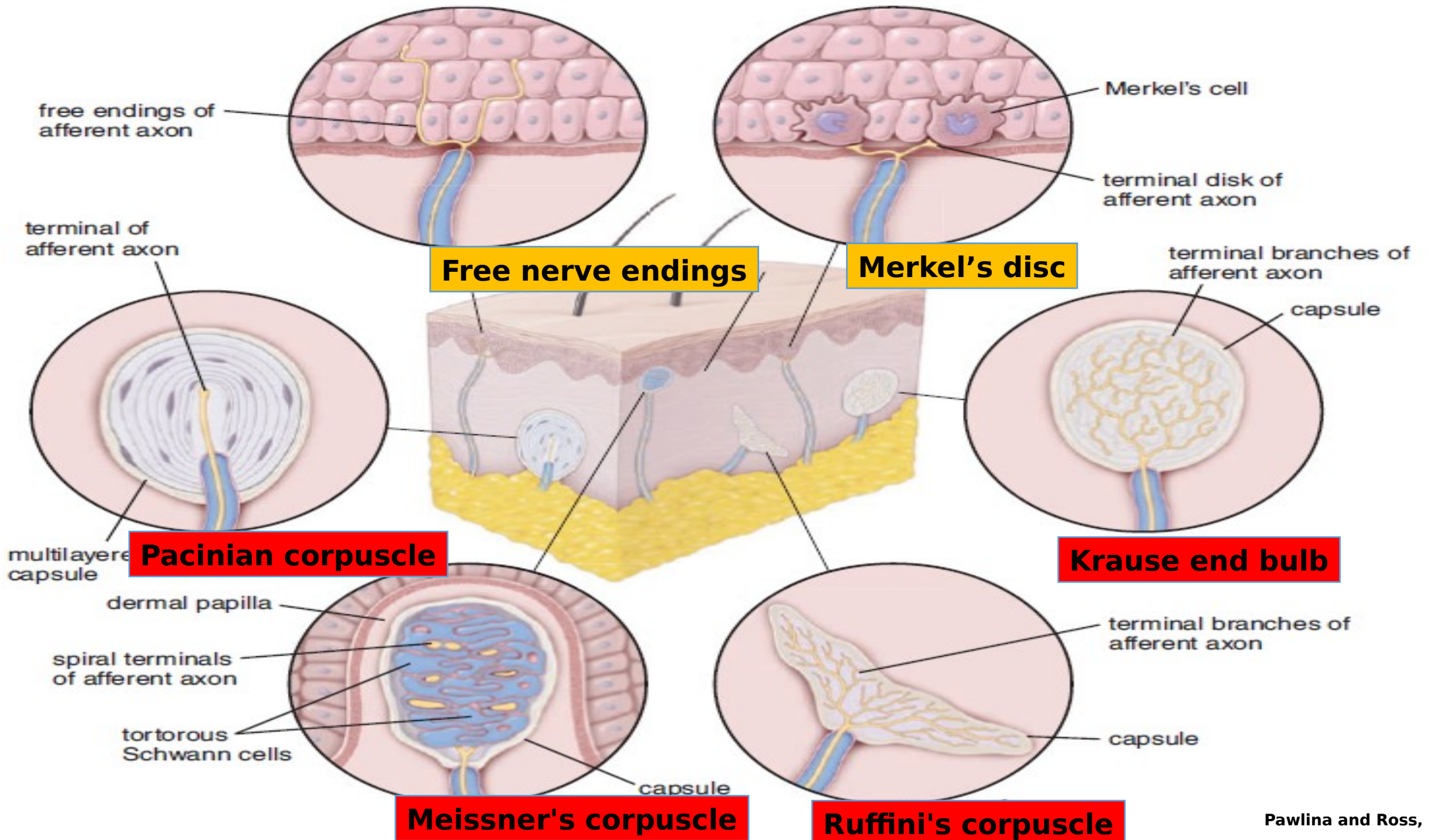
1) Free nerve endings.

1) Meissner's corpuscles.

2) Pacinian corpuscles.

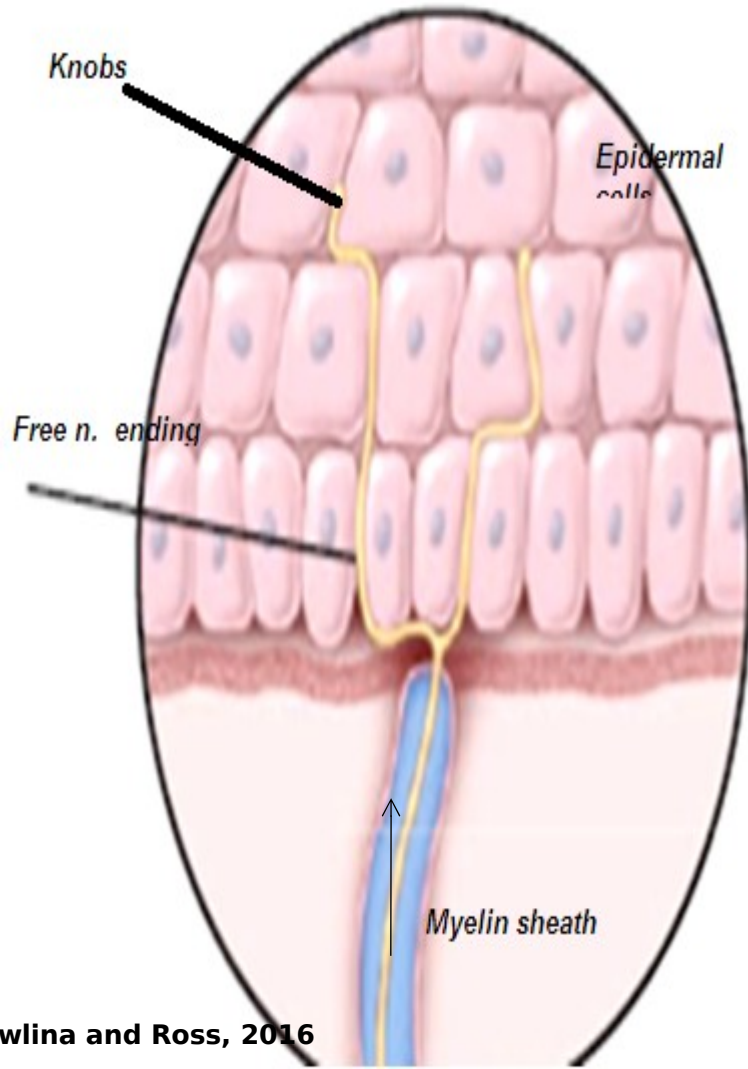
3) Ruffini corpuscles.

4) Krause's end bulbs.



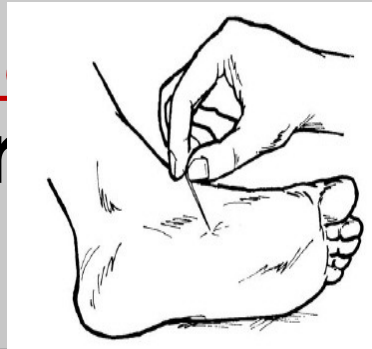
A) Unencapsulated Receptors

1- Free Nerve Endings



- **Site:** skin, cornea, mucus membrane of visceral organs,.....
- **Structure:** as the afferent n. f. approach epidermis → lose their myelin sheath → penetrate epidermis → run between epidermal cells → terminate by **knobs**.

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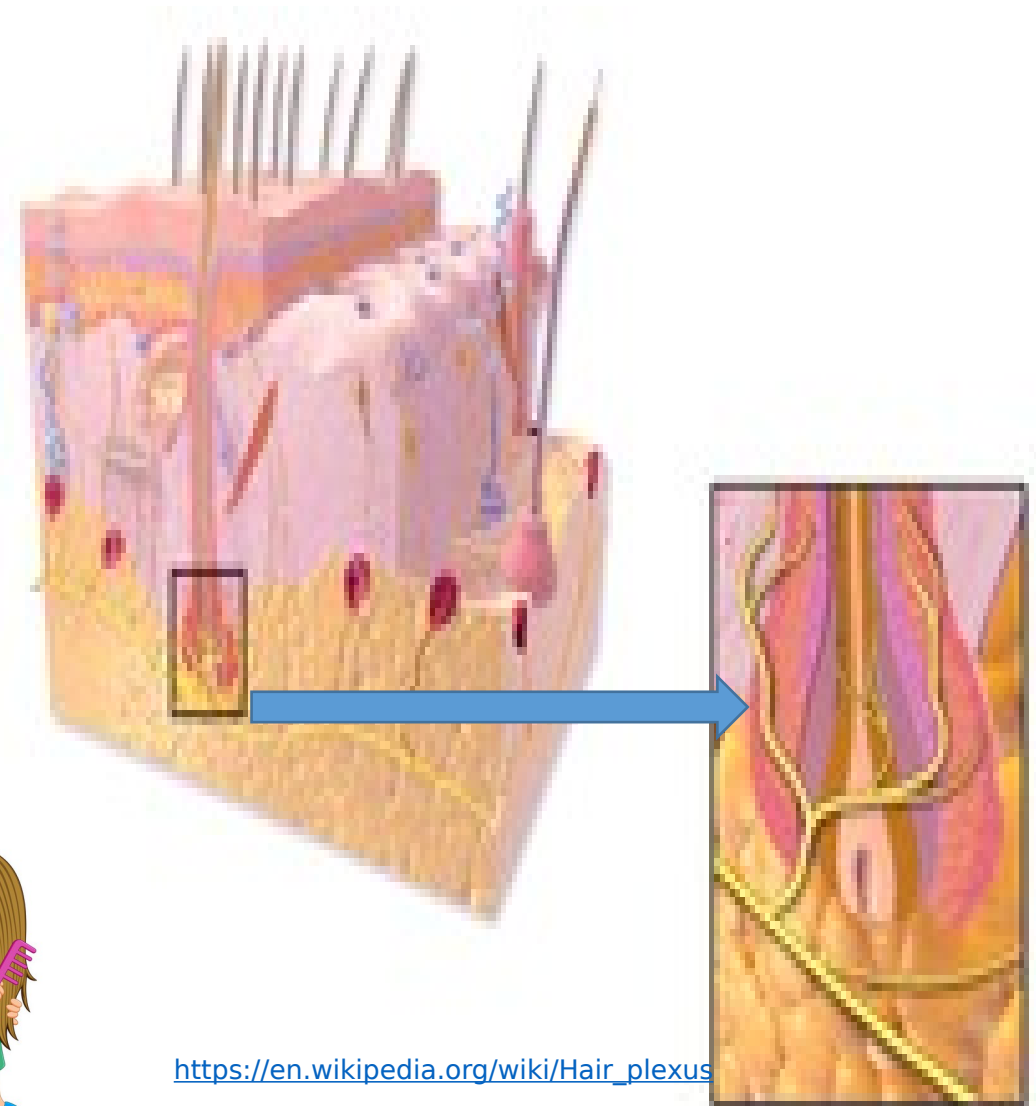


2- Peritrichial Nerve Endings

- **Site:** around shaft of hair below level of sebaceous glands.

- **Structure:** The naked fibers branch and form a *basket-like arborization* around the sheath of the hair follicle.

- **Function:** mechanoreceptors respond to displacement of hairs.



https://en.wikipedia.org/wiki/Hair_plexus

3- Merkel`s Disc



- **Site:** epidermis of the palmer surfaces of hands and planter surfaces of feet.

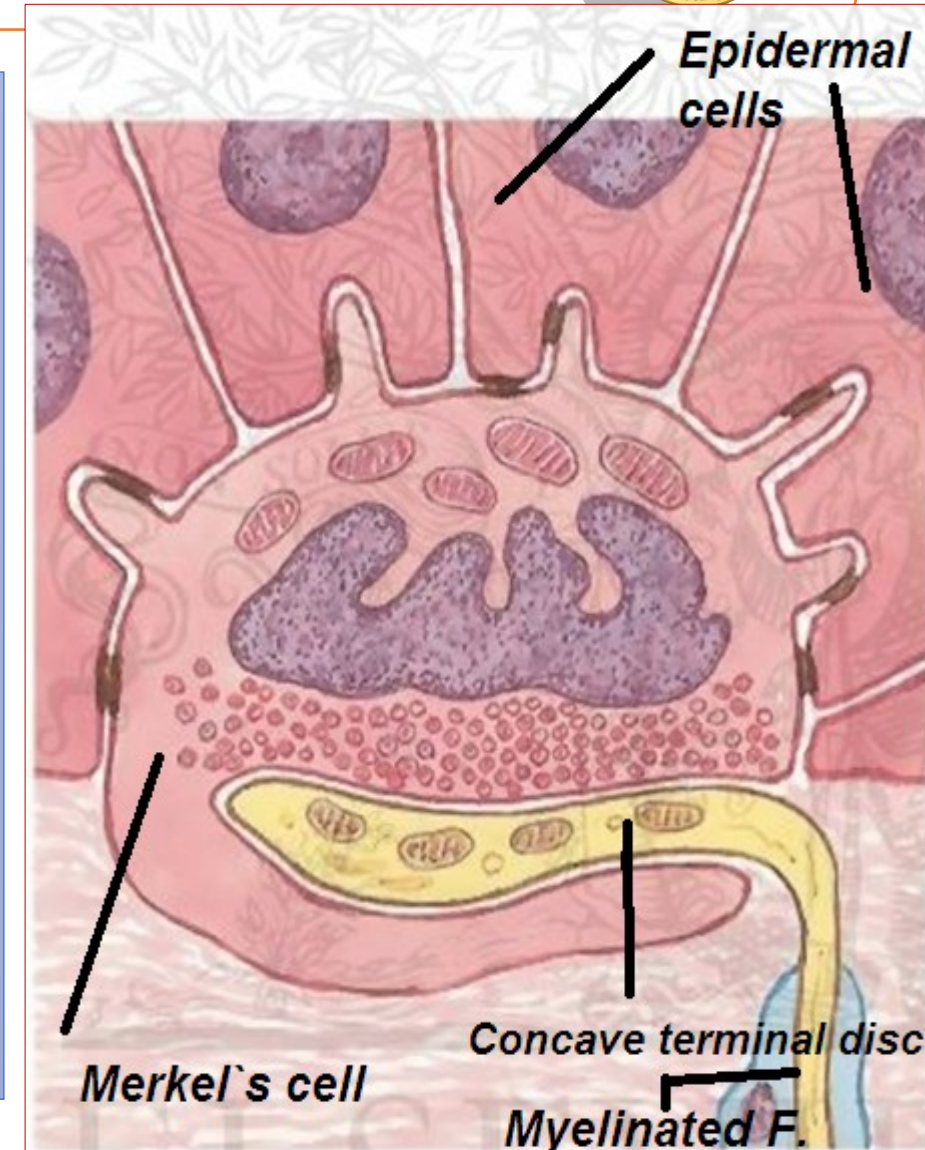
- **Structure:**

The afferent n. f. loses its myelin and Schwann cell sheathes → expands into a **concave terminal disc** → closely applied to the **Merkel's cell**.

- **Function:**



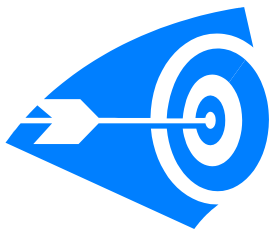
mechanoreceptors are holding



Quiz



- **One of the following is a character of the Merkel`s tactile discs:**
 - 1. They are found between the Schwann cells.**
 - 2. Merkel`s cells are connected to epidermal cells by hemidesmosomes.**
 - 3. They are non-encapsulated receptors.**
 - 4. The nerve fiber forms basket arborization.**

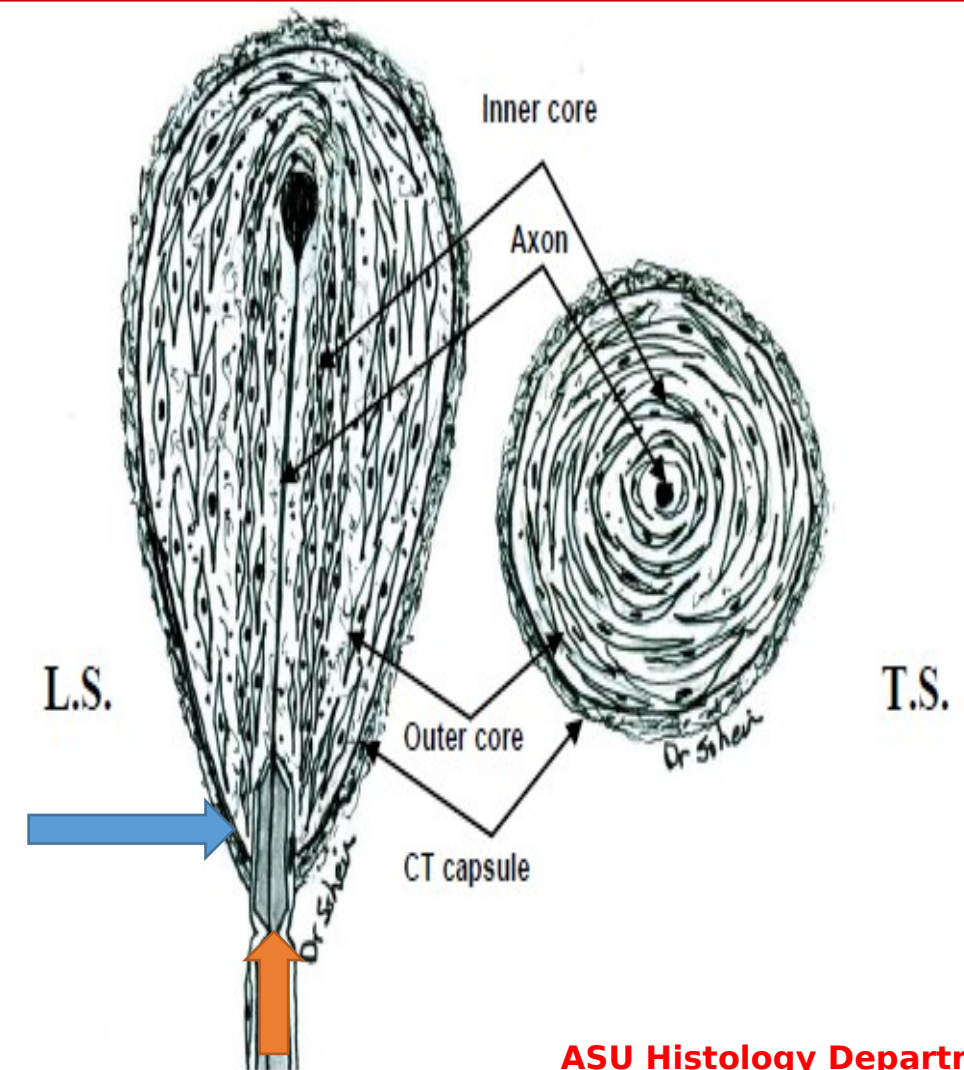


B) Encapsulated Receptors

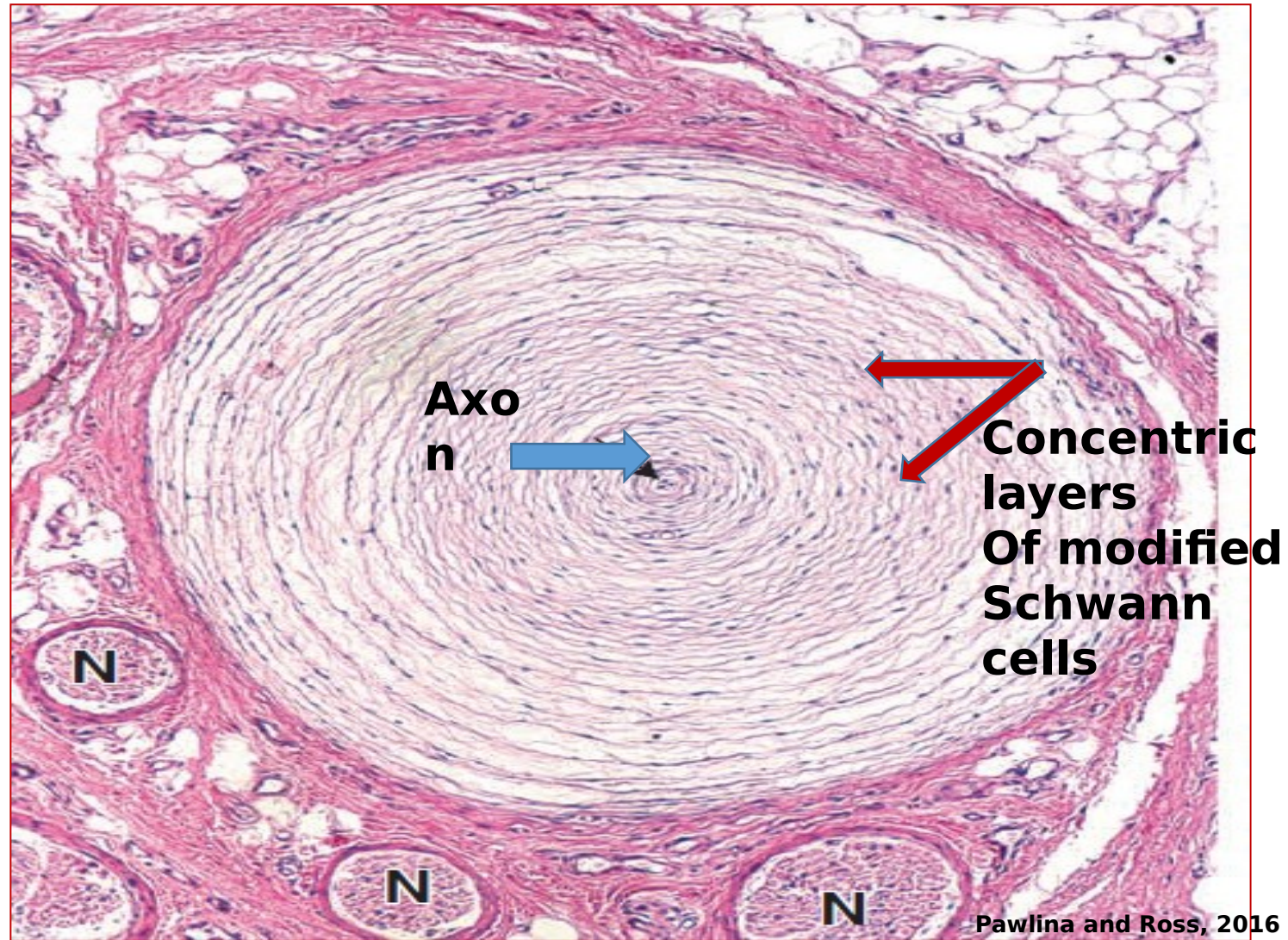
1-Pacinian Corpuscles



- **Site:** dermis, pancreas, periosteum,.....
- **Structure:** large ovoid structure. The afferent n. f. loses its myelin **after** entering corpuscle → runs axially → terminate as **club-like** → surrounded by numerous concentric layers of flattened modified Schwann cells → “**onion**”



Pacinian Corpuscle

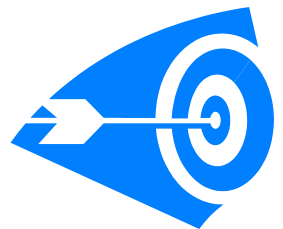


Quiz



• **The sense organ most closely associated with pressure sensation is the:**

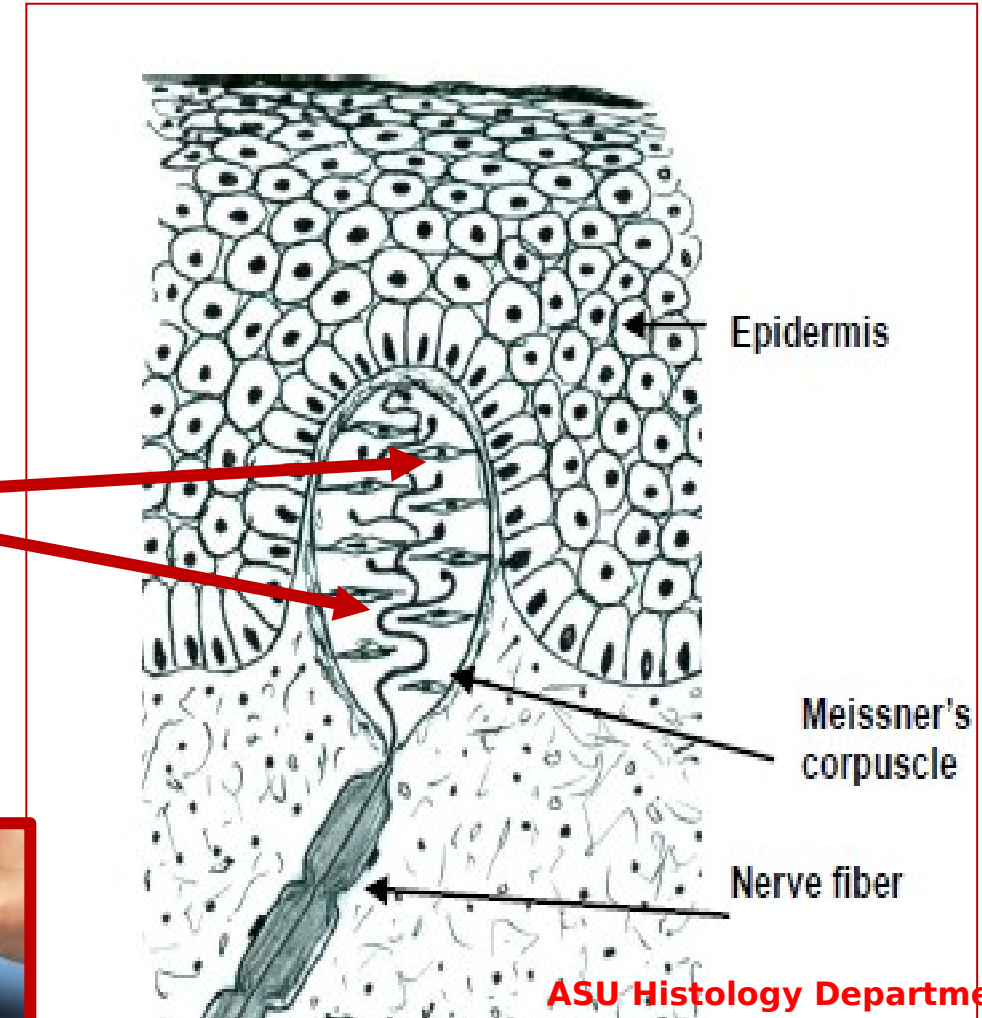
- 1. Meissner's corpuscle.**
- 2. Pacinian corpuscle.**
- 3. Muscle spindle.**
- 4. Golgi tendon organ.**
- 5. free nerve ending.**



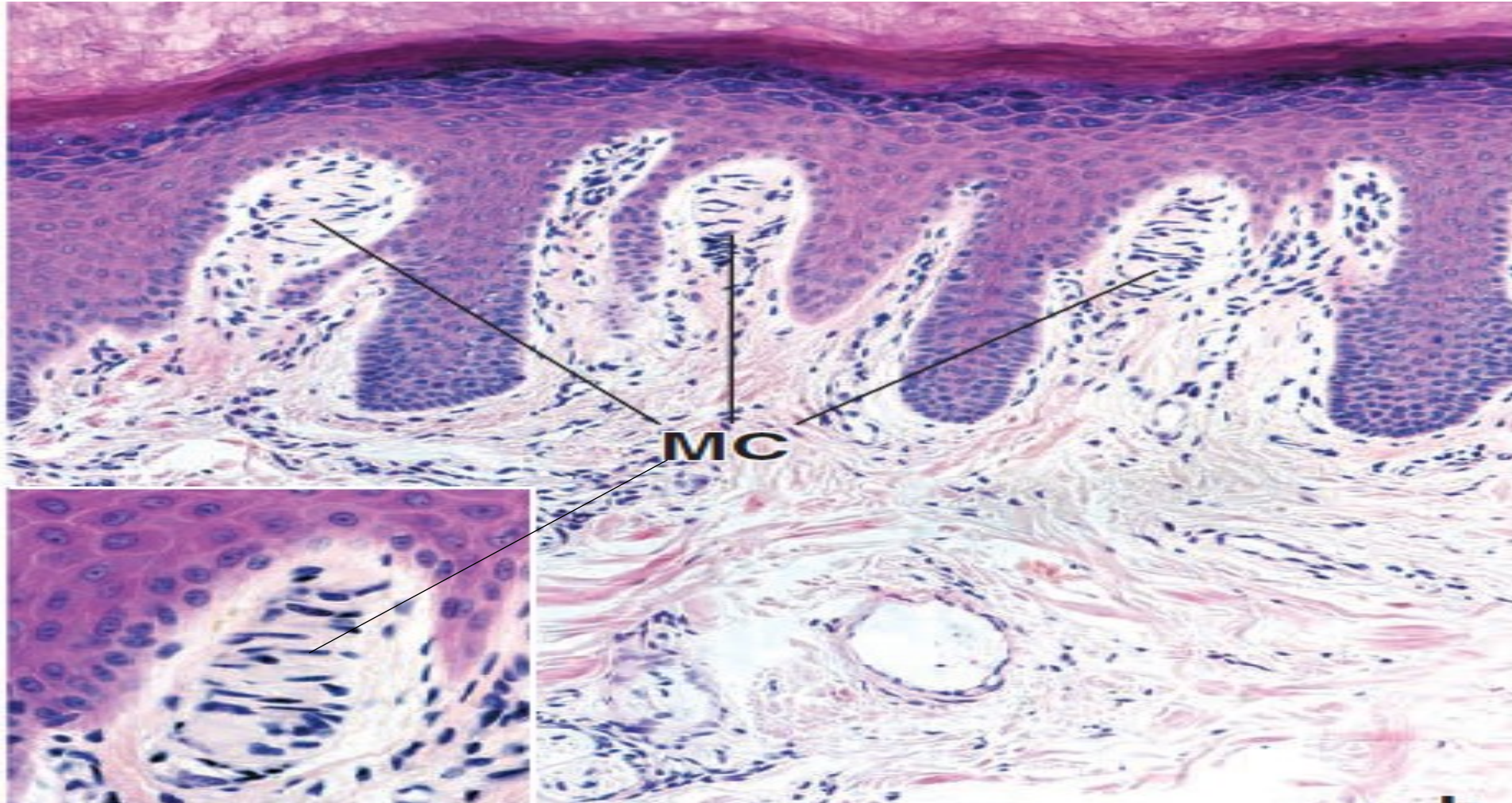
2-Meissner's Corpuscle



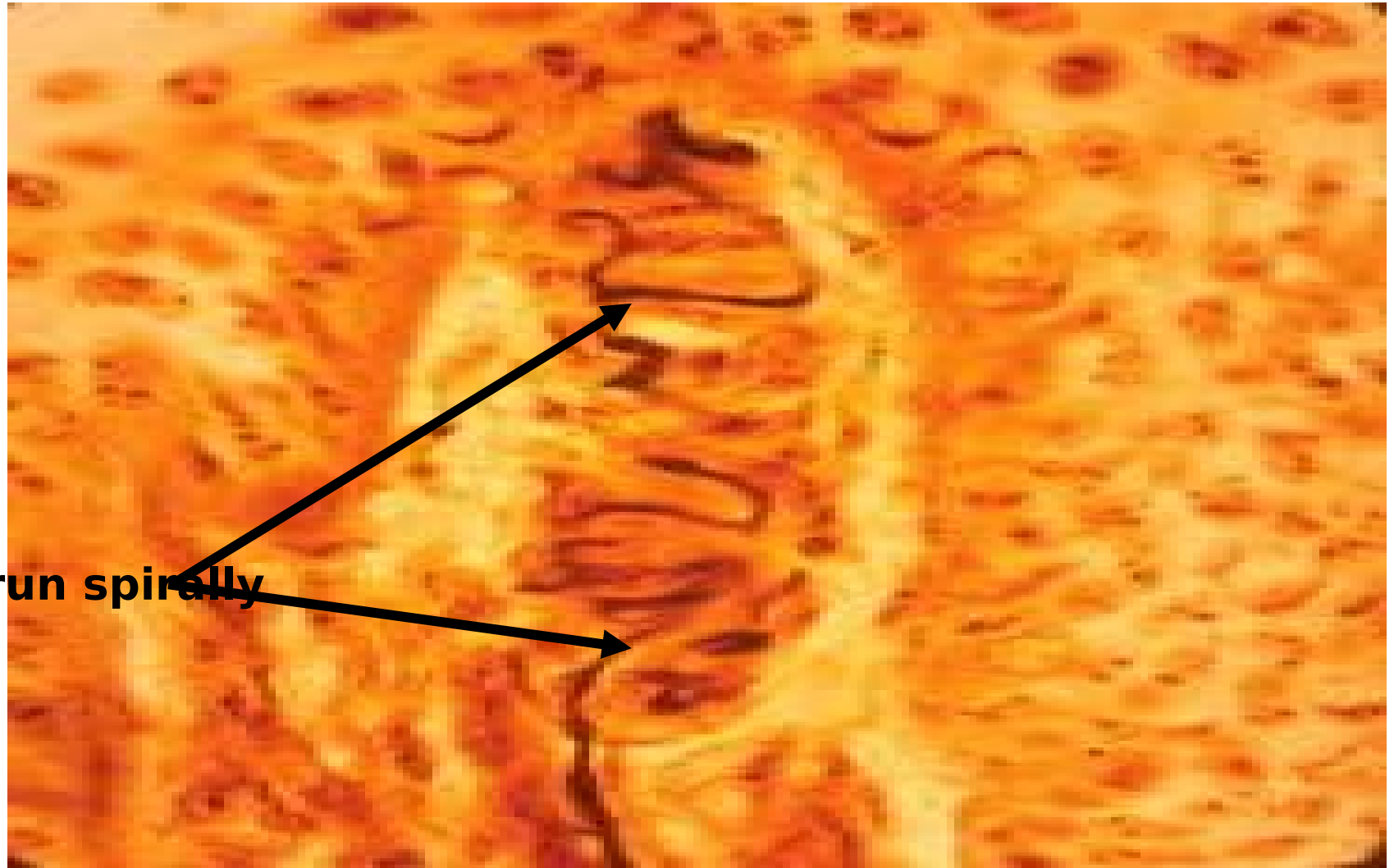
- **Site:** dermal papillae of skin of palms, soles, fingertips.
- **Structure:** oval in shape. After afferent n. f. enter the base of the corpuscle → branch → **run in a spiral course** in between → *transversally oriented flattened Schwann cells.*
- **Function:** respond to fine (light) touch and two points tactile discrimination.



Meissner's Corpuscle



Meissner's corpuscle...silver stain

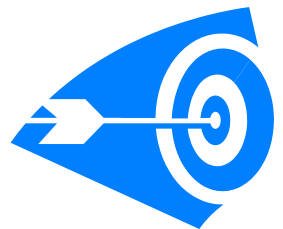


axon of afferent n. run spirally

Quiz



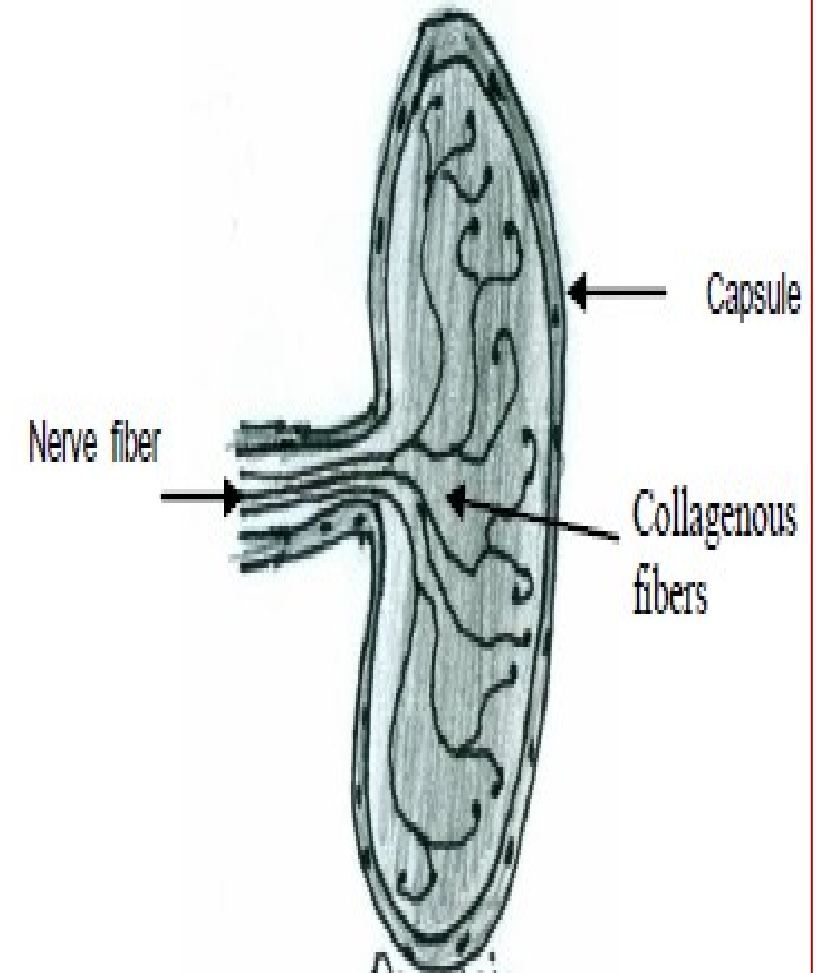
- **One of the following is NOT a character of Meissner's corpuscle:**
 - a) It is an encapsulated nerve ending.
 - b) It is present in dermal papillae.
 - c) The Schwann cells are arranged in two cores.
 - d) The nerve fibers run spirally between the Schwann cells .



3- Ruffini Corpuscle



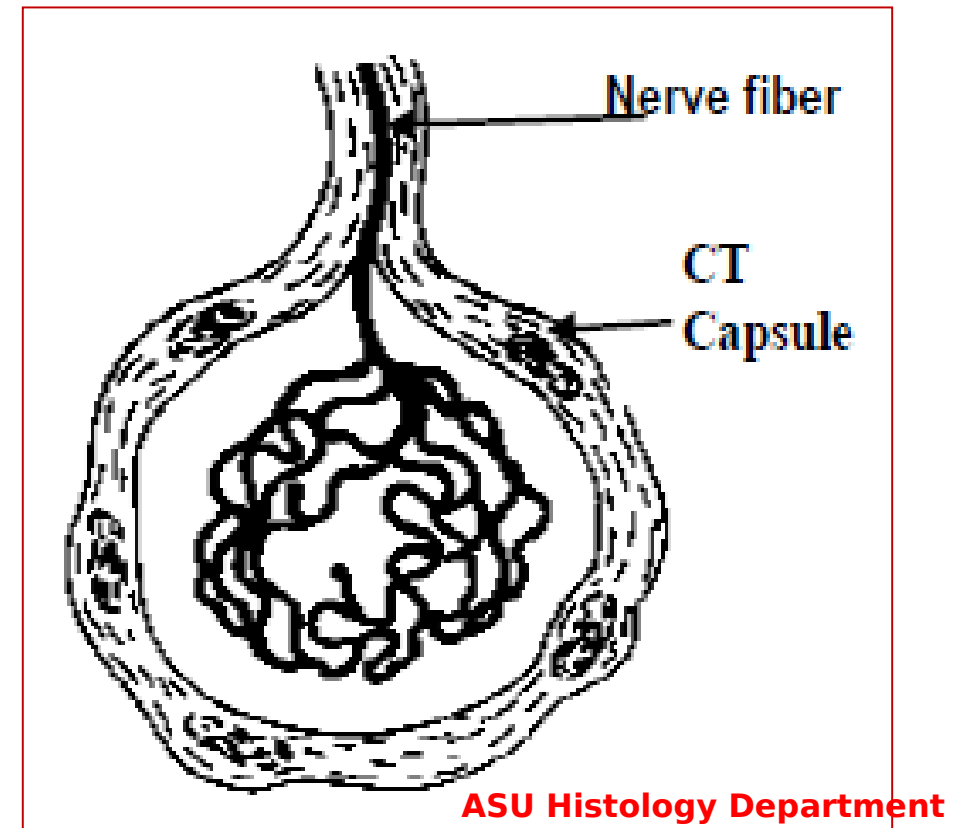
- **Site:** dermis of palms and soles.
- **Structure:** spindle shaped. Afferent n. f. enter corpuscle → loses its myelin → branch extensively → end in between ***core of collagen fibers.***
- **Function:** sensitive to skin



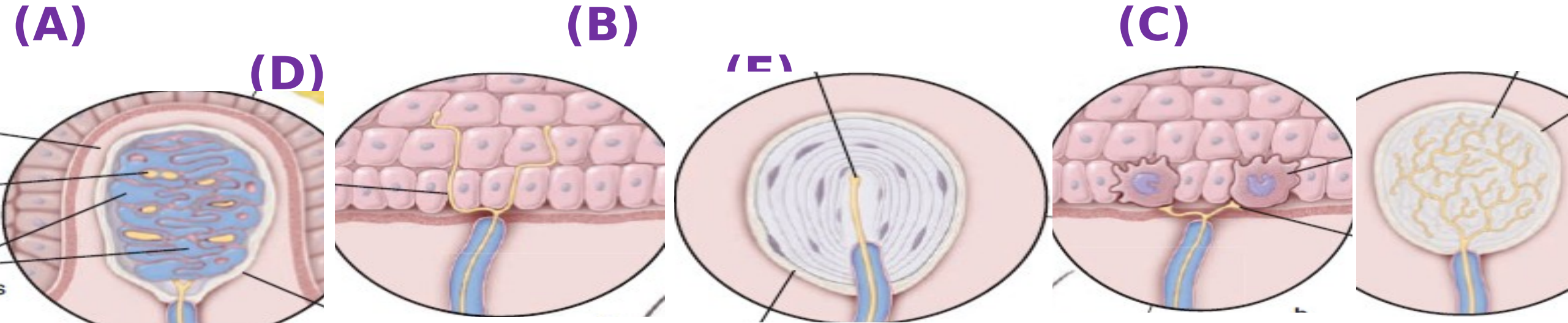
4- Krause end bulb



- **Site:** conjunctiva, mouth, tongue.
- **Structure:** afferent n. f. enter corpuscle → lose myelin → branch to form **network.**
- **Function:** mechanoreceptors



Quiz Match



1- Pacinian
corpuscle

2- Krause end
bulb

3- Meissner's
corpuscle

4- Free
nerve
endings

5- Merkel's disc

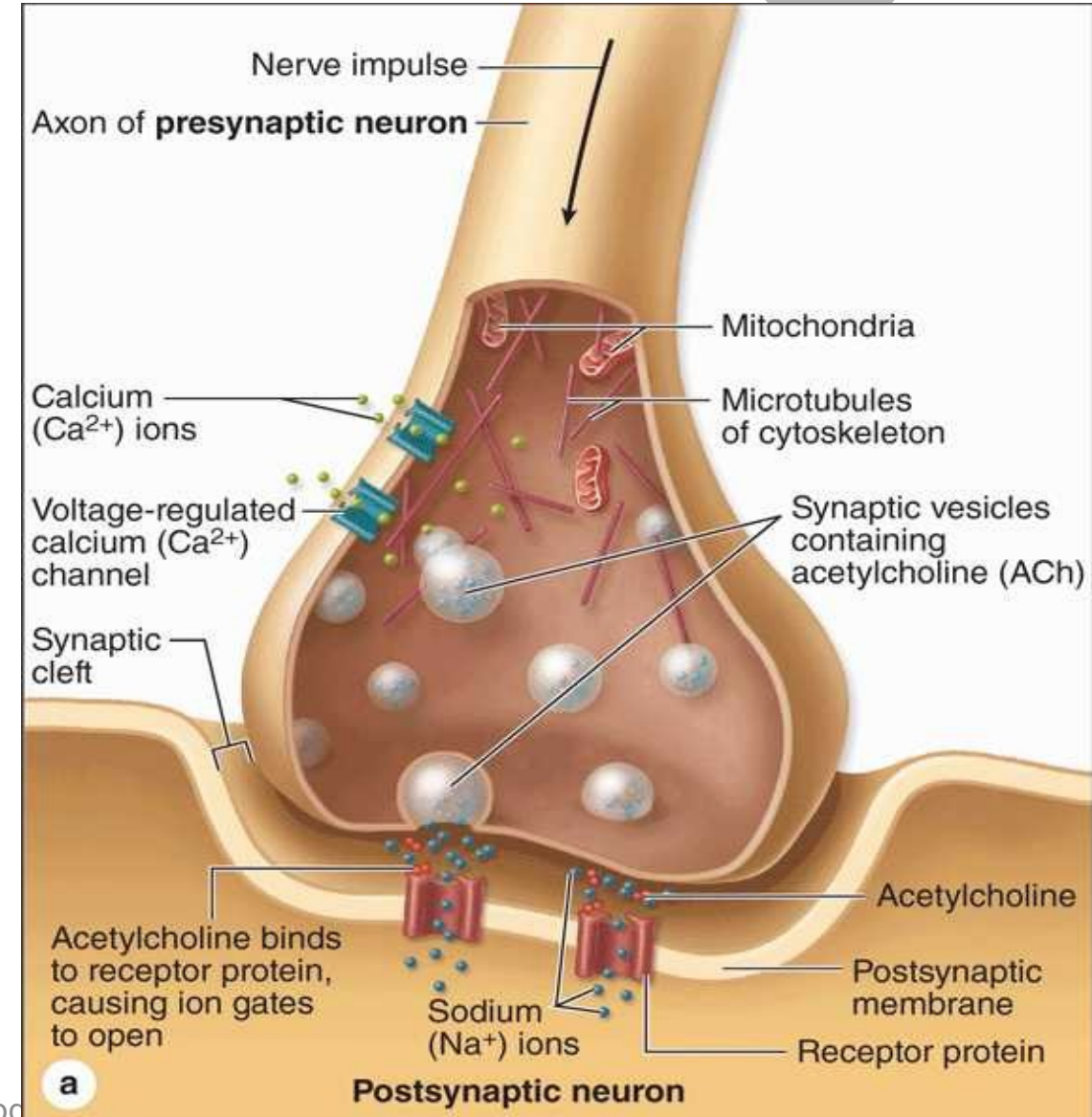
Synapses



- It is the site at which nerve impulses are transmitted from one neuron to another.

► The synapse is formed of:

- 1. The presynaptic terminal:** expanded to form **terminal button**. It contains numerous mitochondria and **neurotransmitter vesicles**.
- 2. The postsynaptic terminal:** with **transmitter receptors** and ion channels to initiate a new impulse.
- 3. The synaptic cleft** is a narrow space (20-30nm) separating the pre- and postsynaptic membranes.



Neuroscience Mod

Types of Synapses

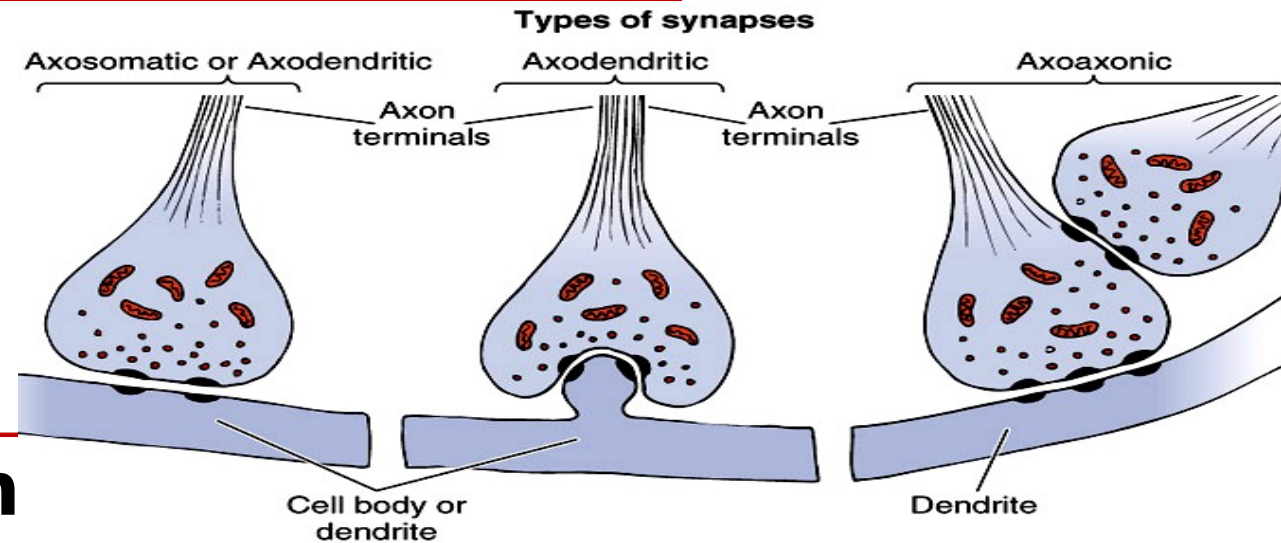


A. Synapses are classified according to the site of termination of the axon on the other neuron:

1. Axodendritic
2. Axosomatic
3. Axoaxonic

B. Functional classification of

1. Excitatory
2. Inh



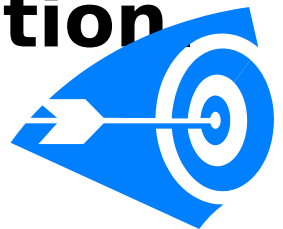
C. Synapses are classified according to the mode of transmission of the nerve impulses:

1. Chemical
2. Electrical
3. Mixed

Quiz



- **Presynaptic terminal is distinguished from postsynaptic membrane by which of the following character?**
- 1. It possesses transmitter receptors.**
 - 2. It contains neurotransmitter vesicles.**
 - 3. Its cell membrane exhibits depression.**
 - 4. Its nerve fiber terminal forms basket arborization**



Lecture main points



✓ Key points:

- **Definition and classification of receptors:** special structures present at the terminal ends of sensory nerves that receive stimuli and transmit them to CNS. They are classified as encapsulated and non-encapsulated receptors.
- **Free nerve endings:** present in skin, cornea, viscera..., the afferent n. fs. lose myelin and run between cells and end as knobs, respond to pain and temperature.
- **Peritrichial nerve endings:** around hair follicles, the naked n. fs. form basket arborization, mechanoreceptors.
- **Meckel's disc:** palms and soles, the naked n. fs. expand forming tactile meniscus related to Meckel's cells, act as mechanoreceptors.
- **Pacinian corpuscle:** deep dermis, periosteum..., the n. f. loses its myelin *after* entering corpuscle → runs axially → terminate as **club-like** → surrounded by numerous **concentric layers of flattened modified Schwann cells** → “*onion appearance*”, *respond to pressure and vibration*.
- **Meissner's corpuscle:** dermal papillae of fingers, the naked n.fs. enter corpuscle run spirally in between transversely oriented Schwann cells, respond to fine touch.
- **Krause end bulb:** conjunctiva, tongue, genital organs..., naked n.fs. enter corpuscle branch to form network, mechanoreceptors.
- **Ruffini's corpuscle:** palms, soles..., naked n.fs. enter corpuscle branch and end in between collagen fs, mechanoreceptors.



Suggested Textbooks

1. Junqueira`s Basic Histology; Text and Atlas. 13th

Edition (2013). From page 198-203.

2. Pawlina and Ross; Histology, A Text and Atlas with Correlated Cell and Molecular Biology. 7th Edition (2016).

3. Snell,RS (2010): Clinical Neuroanatomy. 7th Edition.

From page 95-99.

A background of soft-focus pink flowers, likely cherry blossoms, with delicate petals and green leaves. The text 'Thank You' is written in a black, elegant cursive script across the center.

Thank
You